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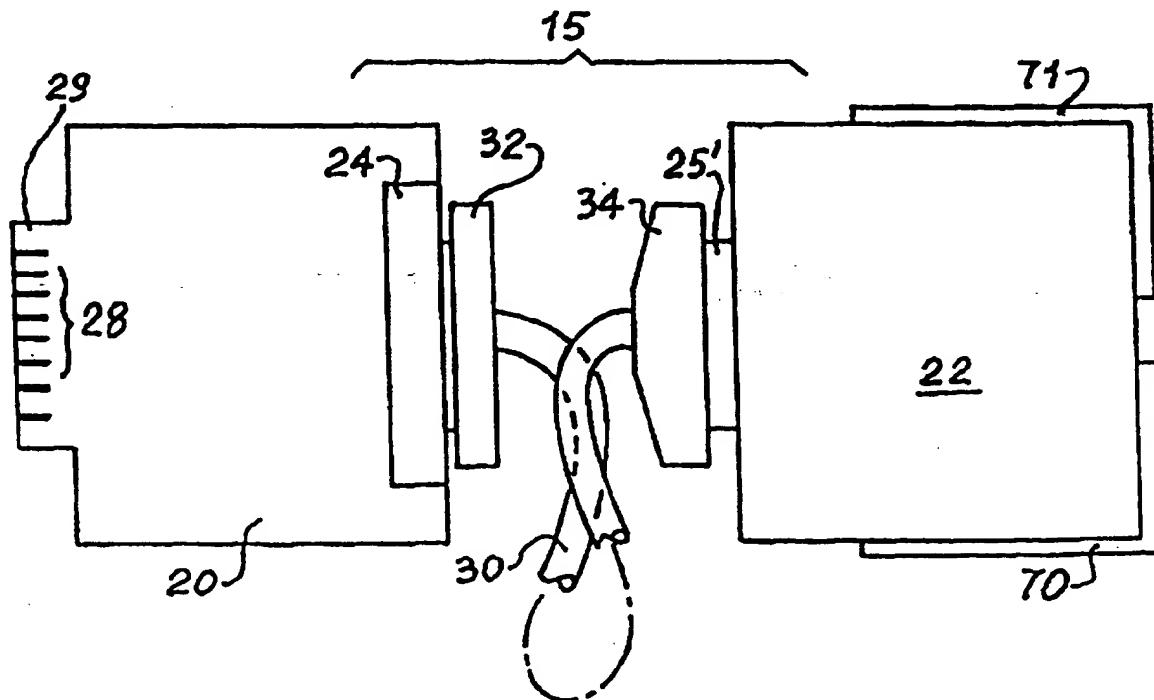
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(54) Title: DATA TRANSMISSION APPARATUS FOR A CORDLESS COMMUNICATION NETWORK



(57) Abstract

A data transmission apparatus via radio for a cordless communication network comprises a personal computer associated with a portable transmission module inserted in disengageable manner in the personal computer; the module consists of an adaptor card connecting to a radio card, also disengageable, and with two L shape, space diversity antennae, fastened to two side walls of the radio module case; the apparatus makes it possible to transmit and receive data to and from a cordless communication network using a computer.

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"Data transmission apparatus for a cordless communication network",

TECHNICAL FIELD OF INVENTION

The present invention relates to a data transmission
5 apparatus for a cordless communication network,
comprising a data processor and electronic transmission
means suitable for connection to the said processor to
enable it to receive and transmit data by radio in
accordance with a predetermined transmission standard.

10 BACKGROUND ART

Currently known through international patent
application WO91/04461 is a portable personal computer
consisting of a base chassis that includes a keyboard
for data entry, a central data processing unit, a mass
15 storage unit for storage of data and programs, and a
plurality of electronic circuits for handling of the
data and management of the programs.

A display unit consisting of a screen and associated
control circuits is mounted on an auxiliary chassis
20 hinged to the base chassis and pivotable in relation to
it.

Housed in special compartments of the base chassis
are a cellular telephone and an interface unit inclusive
of microphone and loudspeaker. The cellular telephone
25 connected to the interface unit and to the electronic
circuits permits communication over a telephone channel
by means of an extractable, rod-type antenna, mounted on
the auxiliary frame, of data and messages with another
personal computer of the same type.

30 This apparatus must necessarily comprise a
modulator-demodulator circuit (modem), to modulate and
demodulate the signals sent and received by the cellular
telephone.

This makes the portable personal computer bulkier and
35 heavier.

Also known, from English patent application 2,241,133, is a cellular radio telephone comprising a main unit containing a microprocessor, a memory, a

5 transmitter/receiver circuit for reception and transmission through an antenna of radio signals processed by the microprocessor in accordance with standard programs housed in memory.

A telephone receiver inclusive of microphone, a

10 loudspeaker and an audio amplifier is connected through a cable to the main unit.

The main unit also includes a housing with a coupling interface for an extractable memory card, of the smart-card type, containing stored information for

15 selection of radio functions and identification of the telephone user.

DISCLOSURE OF INVENTION

The technical problem that this invention intends to solve is that of providing a very compact, light-weight

20 apparatus, making it easy for the user to carry and simple to use, capable of communicating via radio with a cordless communication network and respectively transmitting in digital form voice communications and data processed by a personal computer.

25 The technical problem described above is solved by the data transmission apparatus for a cordless communication network, characterized by transmission means which includes an adaptor module adapting the processor for operation in accordance with a

30 predetermined communication standard, and a radio module connected to the adaptor module for transmission of data to the network.

BRIEF DESCRIPTION OF DRAWINGS

Fig.1 is a block diagram of the apparatus in

35 accordance with the invention;

Fig.2 is a transmission module that may be coupled with the apparatus of Fig.1;

Fig.3 is a block diagram of the adaptor card circuit;

Fig.4 is a block diagram of the radio module;

5 Fig.5 is a view of the radio module, in accordance with this invention;

Fig.6 illustrates assembly of the antennae on the radio module of Fig.5;

10 Fig.7 is a variation on the antennae assembly of Fig.6;

Fig.8 is a preferred, but by no means limiting, embodiment of the apparatus of Fig.1;

Fig.9 is one form of application of the module of Fig. 2 to a telephone receiver;

15 Fig.10 is one application of the module of Fig.2 to a telephone handset.

BEST MODE FOR CARRYING OUT THE INVENTION

With reference to Fig. 1, the number 1 is used to indicate a generic data processor, such as for example a
20 personal computer. The personal computer 1 may be either desk-top type or portable type, also known as a lap-top. The computer 1 is housed in a case 3 and substantially includes a keyboard 5, for data entry, a plurality of electronic circuits 7 arranged on boards 8,
25 housed inside the case 3, a display device 9, for display in a known way of the results of the processing work and a non-volatile mass memory unit 11, of the hard disk type, for example, for storage of data and programs.

30 The plurality of electronic circuits 7 includes at least one microprocessor central unit, not visible, and a bus 10 for input/output of the data in digitized form. The processor 1 is also equipped with special programs for transmission/reception of digital data through a
35 radio communication network.

Naturally, depending on the particular processing model considered, the keyboard and the display may be physically separate from each other and from the processor case, as in the common desk-top personal computers.

Or the keyboard is integrated in the computer, whereas the display is mounted on a flat structure hinged to the case with the additional function of lid, as in the common portable personal computers.

To transform a conventional personal computer, isolated in terms of operation from other computers of the same type, into a device capable of conversing with the world outside, without using cable connections, and without using telephone lines or channels operating via radio links, allowance has been made, in accordance with this invention, for use of a transmission unit 15, which is separate, of extremely reduced dimensions so as to be carried easily in the operator's pocket, with an autonomous power supply, and thus in certain cases equipped with batteries, and easy to insert in and remove from the processor or personal computer as required.

The transmission unit 15 may, at the operator's discretion, be connected to the computer 1 at any time, irrespective of the location, to permit transmission and reception via radio of processed data, each time the operator considers it necessary.

For this purpose, a housing 18 has been included in the case of the personal computer 1, in the shape of a thin slot designed to receive the transmission unit 15, which, when inserted in the housing 18, is electrically connected with the computer's input-output bus 10.

The transmission unit 15 (Fig.2) includes an adaptor module 20, consisting of a first printed circuit board 20, that contains the functional electronic components to adapt the signals produced by the personal computer to a radio transmission standard, for example the DECT

(Digital European Cordless Telecommunication), or GSM (Global System Mobile) standard, and a second card, or radio module 22, that contains the circuits for radio transmission of the signals adapted previously by the module 20.

In accordance with the DECT or GSM standards, the radio module operates in a frequency band of between 1880 and 1900 MHz, on ten channels spaced at 1.728 MHz intervals.

Radio communications between different radio modules 22, belonging to different personal computers in the transmission network occur in a hybrid time and frequency multiplexing system (TDM/FDM), with "double simplex" and "duplex" connections.

Transmission takes place within time cycles or "frames" with a duration of, for example, 10 ms, divided (for example) into 24 slots, half of which are used for transmission and the other half for reception.

The adaptor card 20 can be connected to the radio module 22 through a female connector 24 fitted on the card 20 and a corresponding male connector 25, mounted on the radio module 22.

In turn, the adaptor card 20 may be connected with the input-output bus 10 of the processor 1 through a connector 27 located at the internal extremity of the housing 18. Allowance has been made for a plurality of connection pin-holes 28 for this purpose on one extremity 29 of the card 20.

The pinholes 28 and the connector 27 may be replaced by proximity couplers, without any physical contact, of the capacitive, electromagnetic or optical type, for example IR rays.

The adaptor module 20, rather than directly through the two connectors 24 and 25, may be connected to the radio module 22 by means of a cable 30, of suitable length, to permit the radio module 22 to be set in the

best position for most effective capture of the radio signals emitted by a remote transmitter.

In particular, the cable 30 has two end connectors 32,34 suitable for connection respectively to each of
5 the connectors 24 and 25.

Both the input-output bus 10 of the processor 1, and the cable 30, possess wires for the power supply voltages of the transmission unit 15, as well as the wires needed for the transfer of data and commands.

10 The adaptor module 20 includes (Fig.3) a circuit 40 for interface between the card 20 and the personal computer 1 (fig.1). The circuit 40 (Fig.3) includes a memory 42 and registers 43, with addresses managed by appropriate software parameters and guaranteeing that the
15 interface circuit 40 is highly effective and flexible.

The circuit 40 is connected through a bidirectional bus 46 to other circuits on the card acting to adapt the data processed by the processor 1 in the form of digital signals to the particular transmission standard chosen.

20 The bus 46, a 16-bit bus for example, transfers data, addresses and control signals. Connected in particular to the bus 46 are a RAM memory 50 for storage of the operating programs and transmission and reception data, a circuit 52 controlling the bus 46 and a digital
25 processor 54 for control and management of the entire module 20, on the basis of the timing of an oscillator 58. At the output of the card 20, a circuit 48 providing interface with the radio module 22 is also connected to the bus 46. The circuit 48 interfacing the radio module
30 22 works in accordance with the DECT specifications to control and maintain synchronism of the data received by the radio 22 and to make any reception error corrections required. More particularly, the processor 54 manages transmission and reception of data arranged serially to
35 DECT specifications, performs control and management of the frequencies of the various transmission carriers,

controls synchronism of the slots, and finally detects level of the signals received before selecting through a special algorithm one or the other of two antennae, described later, in order to optimize reception in accordance with the "space diversity" principle.

As already stated above, the bus 46 transfers the power supply voltages directly from the processor 1 to the radio 22, whereas a suitable logic switch housed in the circuit 52 controlling the bus 46 can, if necessary, interrupt this power line if there is allowance for batteries to power the card 20 or both the modules 20 and 22.

Fig. 4 describes a preferred but not exclusive embodiment of the radio module 22 circuit.

The radio module 22 is built on a printed circuit support base 60, partly visible in Fig. 5, with the components arranged on both sides using ASIC technology to give large-scale component integration in an extremely limited area.

The printed circuit 60 is enclosed in a box or case 62 in two halves 63, 64, of extremely small dimensions for this application. In accordance with one, not limiting embodiment, the radio module occupies an area of approximately 54 x 62 x 11 mm.

The inner surface of the halves 63 and 64 is rendered electrically conductive by way of galvanic metalization or application of a thin film of metal, such as aluminium for example.

The contacts of the connector 25 (Fig. 2) are connected to an input-output circuit 65 (Fig. 4) realized using large-scale integration ASIC technology, and containing a gate array for selection and sending of signals to the various components of the circuit. The circuit 65 is connected to a modulator-demodulator circuit 66, comprising one or more medium frequency stages.

The circuit 66 has a dual output 66a, 66b, used for transmission and reception respectively. The outputs 66a and 66b are connected to a deflector 67 and thus to medium frequency IF circuits with associated filters and to a mixing circuit 68. The mixing circuit 68, aided by a PPL (Phase Locked Loop) conversion circuit 69, is used to convert the medium frequency signal into a high frequency signal, suitable for transmission via either one of the two antennae 70,71.

The IF circuits, the mixing circuit 68 and the conversion circuit 69 are used in both transmission and reception, as they can be selected and connected to the transmission line TX, or to the reception line RX by means of the deflector 67.

Set between the mixing circuit 68 and the antennae 70,71 is an front end amplifier circuit 73, comprising a power amplifier 74 for transmission and a pre-amplifier 75 used in reception. A selectively actuated deflector 76 connects the circuit 68 to the power amplifier 74 in transmission, or to the pre-amplifier 75 in reception. The deflector switches 67 and 76 are controlled by special signals received from the card 20 on a conductor 78.

To reduce encumbrance and also for aesthetic reasons, each of the antennae 70,71 (Figs. 5,6) is produced using an L-shaped, sheet conductor 80, and attached on the outside to two lateral surfaces 81,82 adjacent to the box 62.

More particularly, the conductor element 80 is embedded in a bar 84 of synthetic material, transparent to high frequency electromagnetic radiation.

Each antenna 70,71 is fixed to the box 62 and to the board 60 in working position by way of a connection element 86, comprising a metal post 85, integral with the bar 84 and electrically connected at one end 851 to

the conductor 80.

The post 85 exits perpendicularly from the short side 87 of the bar 84 and is inserted precisely in a ferrule 88 of electrically conductive material, attached to the printed circuit board 60 of the radio module housed in the box 62 and connected to one or other of the antenna lines 70a,71a (Fig.4).

To ensure consistent fixing of the bar 84 to the box 62, the connection element 86 also comprises a sleeve 89 integral with the bar 84 and a support 91 attached to the board 60. The sleeve 89 circumscribes the post 85 concentrically and is inserted with slight pressure into a corresponding hole 90 in the support 91 bearing the ferrule 88. In accordance with one variation of fixing of the antenna to the box 62, the sleeve 89 is replaced by a pin 891 (Fig.7) integral with the bar 84 and parallel with the post 85. The pin 891 inserts into a corresponding hole in the box 62.

Moreover, a tooth 92, integral with the long end 93 of the bar 84, engages in a corresponding notch 94, made in the thickness of the side wall 82. The tooth 92 prevents the long side 93 of the antenna from sliding parallel with the post 85, grazing against the side wall 82 and becoming detached accidentally from the box 62. The antennae 70,71 may be removed and substituted with other antennae, rod antennae for example, each of which inserted in the corresponding ferrule 88.

To separate the antenna 70 (or the antenna 71) from the box 62, the end of the long side 93 should be pulled towards the outside of the box 62, as shown by the arrow 95, and the post 95 then removed from the ferrule 88 along the axis.

INDUSTRIAL APLLICABILITY

Fig.8 is an example of application of the transmission unit 15 on a commercial personal computer 100, for example the OLIVETTI PHYLOS model.

The computer 100 is equipped with a housing 102 in one side 104. The housing 102 extends inside the computer casing and includes a connection element, not visible, such as the connector 10 of Fig.1, connecting the unit 15 to an input-output bus, again not visible, of the computer.

The adaptor module 20 is fitted into the housing 102, whereas the radio module 22, connected to the adaptor module 20 by means of a cable 105, is attached by an elastic clip fastener 106 to a part of the computer casing, to the lid-display 107 for example. In this way, the radio module does not interfere with the work of the operator and may be disposed in the most suitable position for optimum reception of radio signals.

Naturally the unit 15 may be inserted in the housing 102 in its complete form, i.e. with the adapter module 20 connected directly to the radio module 22.

On the preceding pages, the transmission unit 15 (Fig. 1) was described, separate and distinct from data processing apparatus, independent and portable, consisting of the combination of an adaptor module 20 with a radio module 22.

Also described, with reference to Fig.8, was utilization, in a first embodiment of the invention, of the transmission unit 15, associated with a personal computer, preferably portable, for radio trasmission of the data processed by the computer to another computer of the same type, belonging to a cordless data communication network.

Fig.9 illustrates another application of the

transmitter module 15 in combination with a passive telephone receiver 110, i.e. with only a microphone 112, a loudspeaker 114, and a voice amplifier circuit 115, connected internally to both the microphone and the loudspeaker 114. A receiver connection cable 116, with a connector 117, provides connection of the receiver 110 to the adaptor module 20, in turn inserted in a personal computer 120. The receiver 110 has a housing 118 designed for the radio module 22.

At the bottom of housing 118 is a connector 119 through which the radio module 22 and the circuit 115 are connected to the module 20. The personal computer 120 includes circuits, not illustrated, for voice management of a known type and not explained in detail in this description, which receive the voice signals in analog form from the receiver 110 and convert them to digital signals, subsequently sent via the adaptor module 20 and the cable 116 to the radio module 22 for transmission by radio.

Similarly in reception, digital signals representing a voice communication received by the radio module 22, are sent along the cable 116 to the personal computer 120 and from here, after conversion to analog signals, to the receiver 110.

It will be clear that, by linking a passive receiver to a personal computer through the adaptor 20 and radio modules, as described in the foregoing, an operator can communicate viva voce with a correspondent simply by inserting the radio module 20 in the receiver 110 and connecting the cable 116 to the adaptor module 20, in place of the radio module used as described in relation to Fig.1, for data communication purposes.

Fig.10 illustrates a further application of the adaptor 20 and radio 22 modules.

A portable handset 130 includes a microphone 131, a

loudspeaker 132, the associated amplification circuit similar to the one 115 used for the receiver 110 of Fig.9. Moreover, the handset 130 includes a display 133, a telephone keypad 134, with associated handler
5 circuits, controlled in some cases by a microprocessor. These circuits are of a known type and are not shown in Fig.10 for the sake of simplicity.

The adaptor 20 and radio 22 modules may be inserted in a housing 135, which includes a connector 136 to
10 receive the end 29 (Fig. 2) of the card 20. The radio module 22 is connected directly to the card 20 through connectors of its own, as described in the foregoing.

The handset 130 also includes a housing 137 for batteries for independent power of the handset's
15 circuits and the modules 20 and 22.

The handset 130 can therefore communicate via radio with an apparatus of the type described in Fig.1, or in Fig.8, in which the respective personal computers include the circuits and programs for voice management. It
20 remains understood that the data transmission apparatus for a cordless communication network, in accordance with this invention may be subject to changes, additions or substitutions of parts, without departing from the scope of this invention.

For example, the handset 130 (Fig.10) could have a
25 further housing 138 in the form of a slot, associated with an appropriate coupling element, for insertion and reading of fixed data from a portable memory card 139, of the smart card type, such as for example an
30 operator identification code, telephone numbers, addresses of correspondents, etc.

In addition, the handset 130 may include a device 140 for infra-red type interface with the outside, for transmission and reception in limited areas.

Yet again the handset 130 could have an outlet for a printer connection cable and contain the control circuits needed to receive texts to be printed.

CLAIMS

1. An apparatus for data transmission to a cordless communication network, comprising a data processor and electronic transmission means suitable for connection to said processor, characterized in that said transmission means includes an adaptor module adapting said processor for operation in accordance with a predetermined communication standard, and a radio module connected to the said adaptor module for transmission of said data to said network.
2. An apparatus in accordance with claim 1, characterized in that said data processor includes a personal computer with a housing designed to receive said adaptor module, said personal computer having at least one data input - output bus connected to a connector arranged in said housing to connect said adaptor module to said bus.
3. An apparatus according to claim 1 or 2, characterized in that said radio module includes an autonomous, separate and portable radio transmitter/receiver unit, including means of connection with said adaptor module, for enabling said processor to transmit and receive data by radio in accordance with a predetermined communication standard.
4. An apparatus according to claim 3, characterized in that said radio transmitter/receiver unit includes a plurality of electronic components mounted on a printed circuit support element closed within a box with a metallic inner surface, said electronic components being connected on the one hand to said connection means and on the other to a system of antennae for broadcasting and/or transmitting said data.
5. An apparatus according to claim 4, characterized in that said system of antennae comprises two identical and independent antennae.

6. An apparatus according to claim 5, characterized in that said electronic components include an input-output circuit connected to said means of connection, a front-end, high frequency amplification circuit, connected to said antennae, and intermediate frequency circuits, frequency conversion circuits and modulation - demodulation circuits.

7. An apparatus according to claim 6, characterized in that said front-end circuit is connected selectively to one or other of said antennae by means of a pair of antenna lines, selected by a deflector circuit controlled by said adaptor module.

8. An apparatus according to any of the claims from 4 to 7, characterized in that said antennae include a conductor element enclosed in a resin case in the form of a long bar and composed of two contiguous parts, bent at right angles to each other, said bar being fixed to two adjacent walls of said case.

9. An apparatus according to claim 8, characterized in that each of said antennae is removably connected to said printed circuit element by means of a connection member.

10. An apparatus according to claim 9, characterized in that said connection member includes a support mounted on said printed circuit, bearing a ferrule designed to receive in disengageable manner a metal post connected rigidly to a conductor element of said antennae, said connection member also including a cylindrical element protruding from said bar parallel with said post and designed for insertion in a corresponding seat in said case.

11. An apparatus according to any one of the claims 8, 9, or 10, characterized in that said metal post is fixed to a first of said contiguous parts, and that a tooth integral with a second of said parts is

inserted in a corresponding notch in said case to hold said antenna in its working position.

12. An apparatus for data transmission over a cordless communication network, using a personal computer housed
5 in a casing with at least one compartment communicating with the outside of said casing, and comprising a central processing unit for digital processing of information and at least one input and output bus for
10 said information, said apparatus including transmission means suitable for connection to said bus to transmit and receive from said communication network the information processed by said central unit and respectively signals transmitted by said communication network, characterized
15 in that said communication means includes a first electronic adaptor card, distinct from said personal computer, portable and inserted in disengageable manner in said compartment to enable said central unit to work according a predetermined communication standard and a second radio transmitter/receiver card, distinct
20 from said personal computer and said adaptor card, portable and connecting to said first adapter card for transmission and reception from said communication network of said information.

13. An apparatus according to claim 12, characterized in
25 that the said bus is connected to a connector arranged inside the said compartment to connect the said adaptor card to the said bus, when it is inserted in the said compartment.

14 An apparatus according to claim 12 or 13,
30 characterized in that said adaptor card and said radio card include respectively a first and a second coupling member and that said radio card is connected to said adaptor card by means of a cable connected between said coupling members.

35 15. An apparatus according to any of the claims 12, 13, or 14, characterized in that said radio

transmitter/receiver card includes a plurality of electronic circuit components mounted on a printed circuit base enclosed inside a box of essentially parallelepiped shape, said circuit components being
5 connected to a pair of antennae, each fixed on the outside to two side walls, adjacent to said box.

16. An apparatus according to claim 15, characterized in that each of said antennae includes a conductor element enclosed inside a resin case in the shape of a
10 long bar and consisting of two contiguous parts, bent at right angles to each other.

17. An apparatus for data transmission over a cordless communication network, using a personal computer housed in a casing with at least one compartment communicating
15 with the outside of said casing, and comprising a central processing unit for digital processing of information and at least one input and output bus for said information, said apparatus including transmission means suitable for connection to said bus to transmit and
20 receive from said communication network the information processed by said central unit and respectively signals transmitted by said communication network and a telephone receiver with a microphone and a loudspeaker and a connection cable, characterized in that said
25 transmission means includes a first electronic adaptor card, distinct from said personal computer, portable and inserted in disengageable manner in said compartment to enable said central unit to work according to a predetermined communication standard and a second radio
30 transmitter/receiver card, distinct from said personal computer and said adaptor card, portable and engageable in a housing in said telephone receiver in an operating connection with said first adaptor card through said cable, for transmission and reception from
35 said transmission network of said information,

selectively by means of said computer and said receiver.

18. An apparatus according to claim 17, characterized in that said receiver comprises a coupling member
5 arranged inside said housing, for coupling with said radio card, an amplification circuit for said microphone and for said loudspeaker, connected to said member, said connection cable being connected between said member and said adaptor card to connect the radio card coupled with
10 the receiver to the adaptor card inserted in the personal computer.

19. An apparatus for data transmission over a cordless communication network, using a personal computer housed in a casing with at least one compartment communicating
15 with the outside of said casing, and comprising a central processing unit for digital processing of information and at least one input and output bus for said information, said apparatus including transmission means suitable for connection to said
20 bus to transmit and receive from said communication network the information processed by said central unit and respectively signals transmitted by said communication network and a handset with a microphone and a loudspeaker, a display screen, a keyboard,
25 electronic control circuits, characterized in that said transmission means includes a first electronic adaptor card, distinct from said personal computer, portable and enabling the said central unit to work according to a predetermined communication standard and a
30 second radio transmitter/receiver card, distinct from said personal computer and said adaptor card, portable and connected to said first adapter card, said first and second card being engageable, when coupled together, in a housing in said handset, for transmission and reception
35 from said communication network of said information.

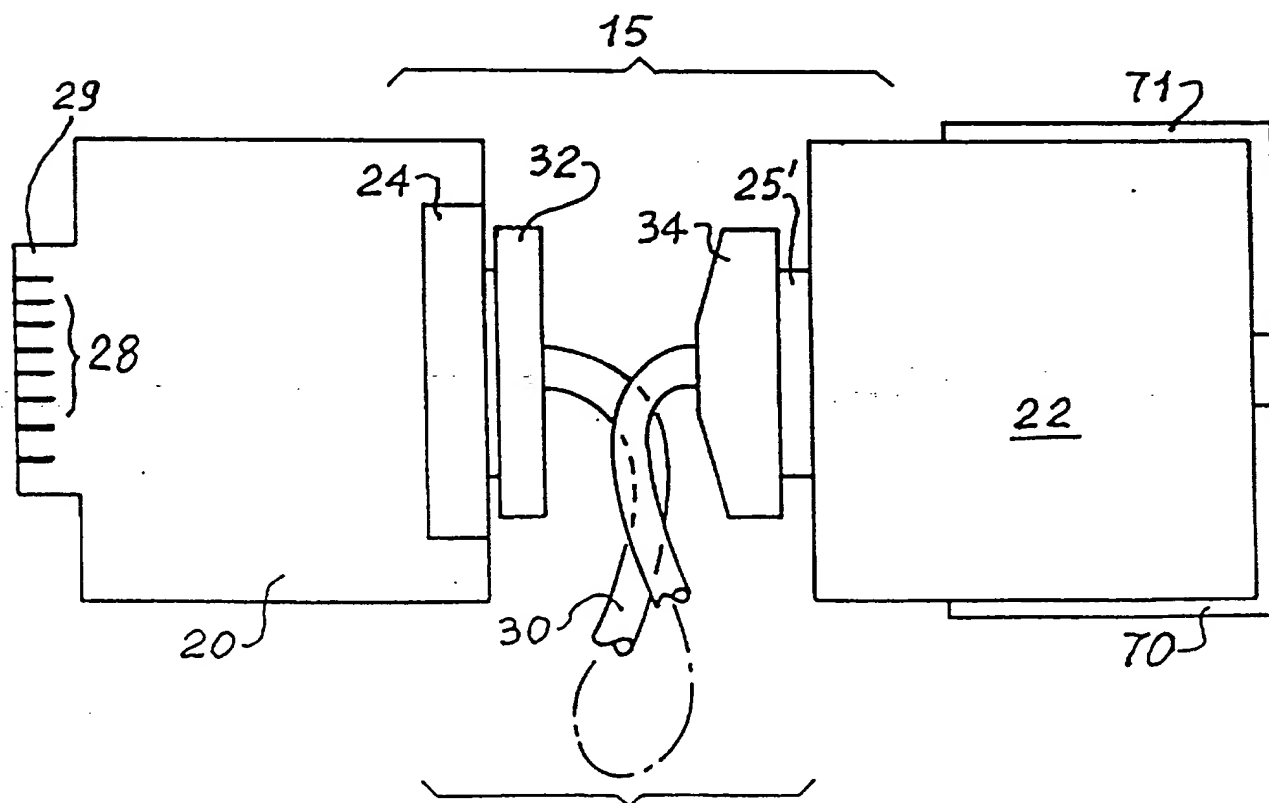
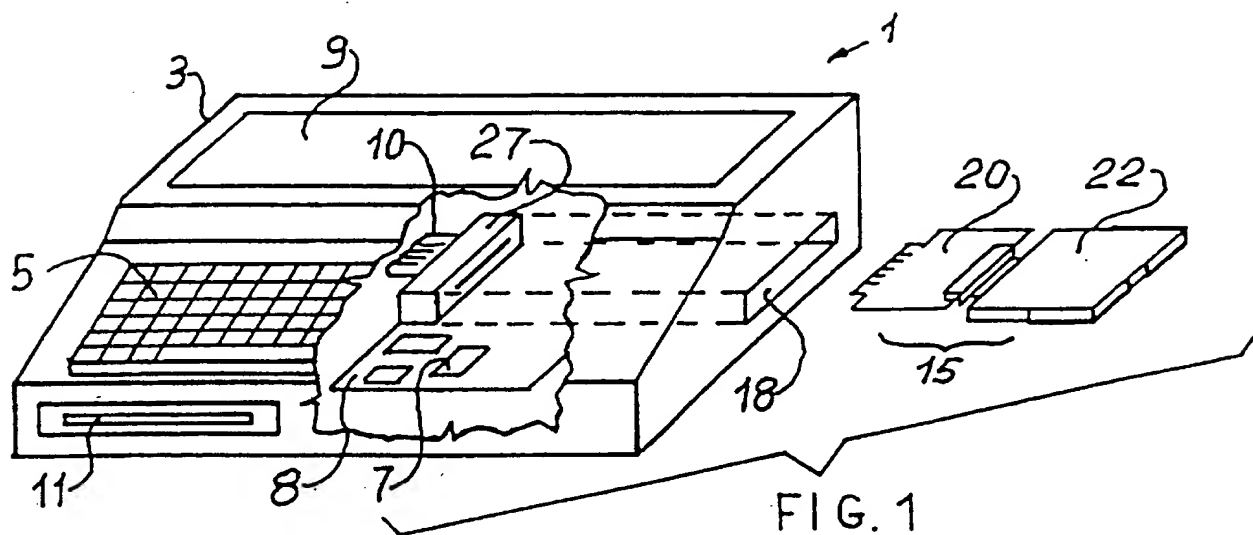
20. An apparatus according to claim 19, characterized in that said personal computer houses in said compartment a first adaptor card connected to a second radio card disposed adjacent to said computer, to communicate with
5 said handset.

21. A radio transmitter/receiver module for an apparatus for data transmission over a cordless communication network, comprising a digital information processor, said module comprising a plurality of circuit components
10 receiving the digital information and converting it into high frequency radio signals broadcast by a system of antennae connected to said circuit components, characterized in that said components are contained in a box of substantially parallelepiped shape and that said
15 system of antennae includes two identical and distinct antennae, each being bent at right angles and arranged on two lateral walls, adjacent to said box.

22. A module according to claim 21, characterized in that said antennae include an electrical connection
20 element between a conductor of said antennae and said circuit components, and a fixing member integral with said antennae and combining with said box to hold said antennae in the working position.

23. A module according to claim 22, characterized in that said antennae include a first arm and a second arm
25 joined together at right angles, said electric connection element consisting of a metal post fixed to said first arm, and said fixing member comprising a tooth integral with said second arm and combining with a
30 corresponding notch in said box.

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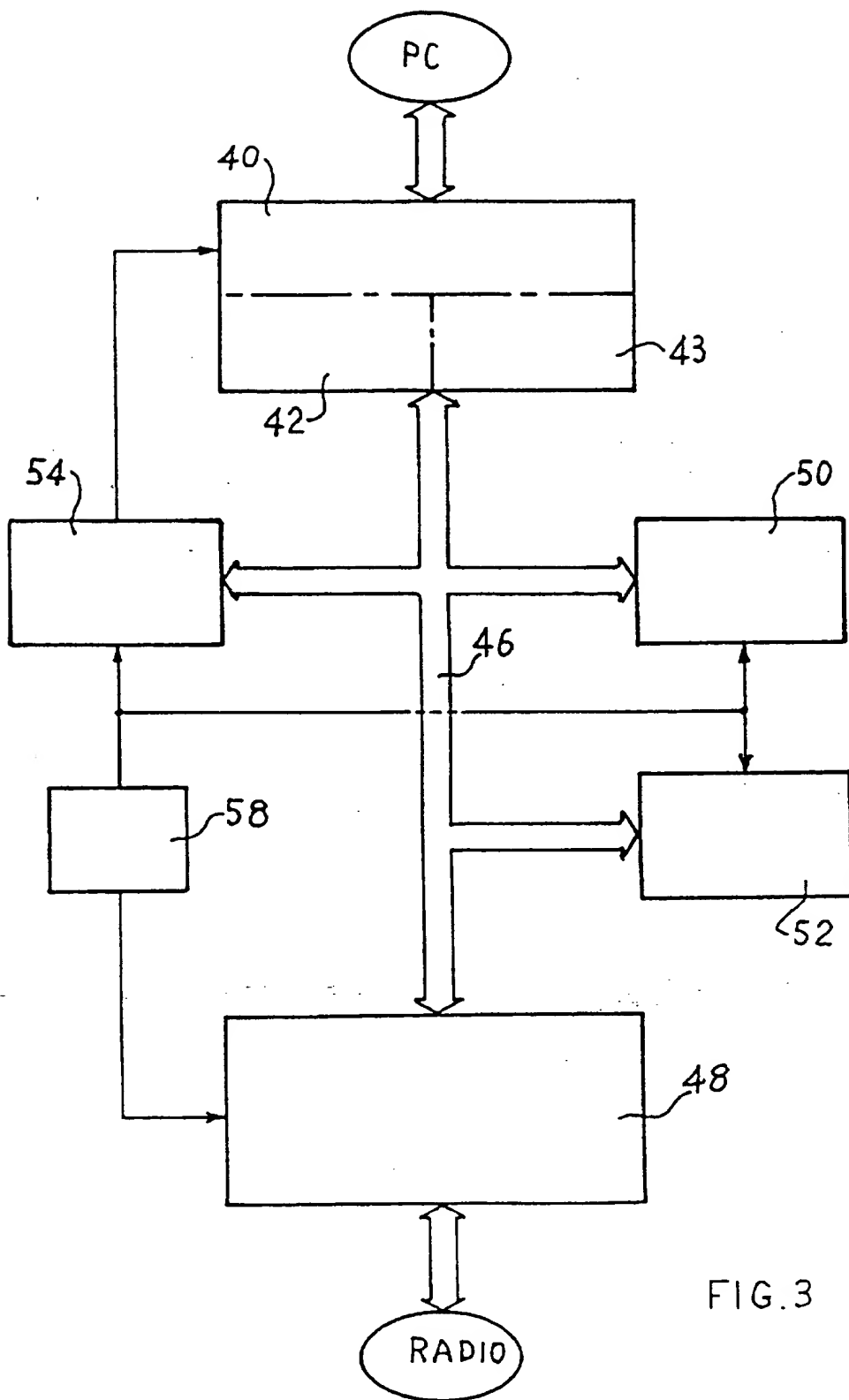
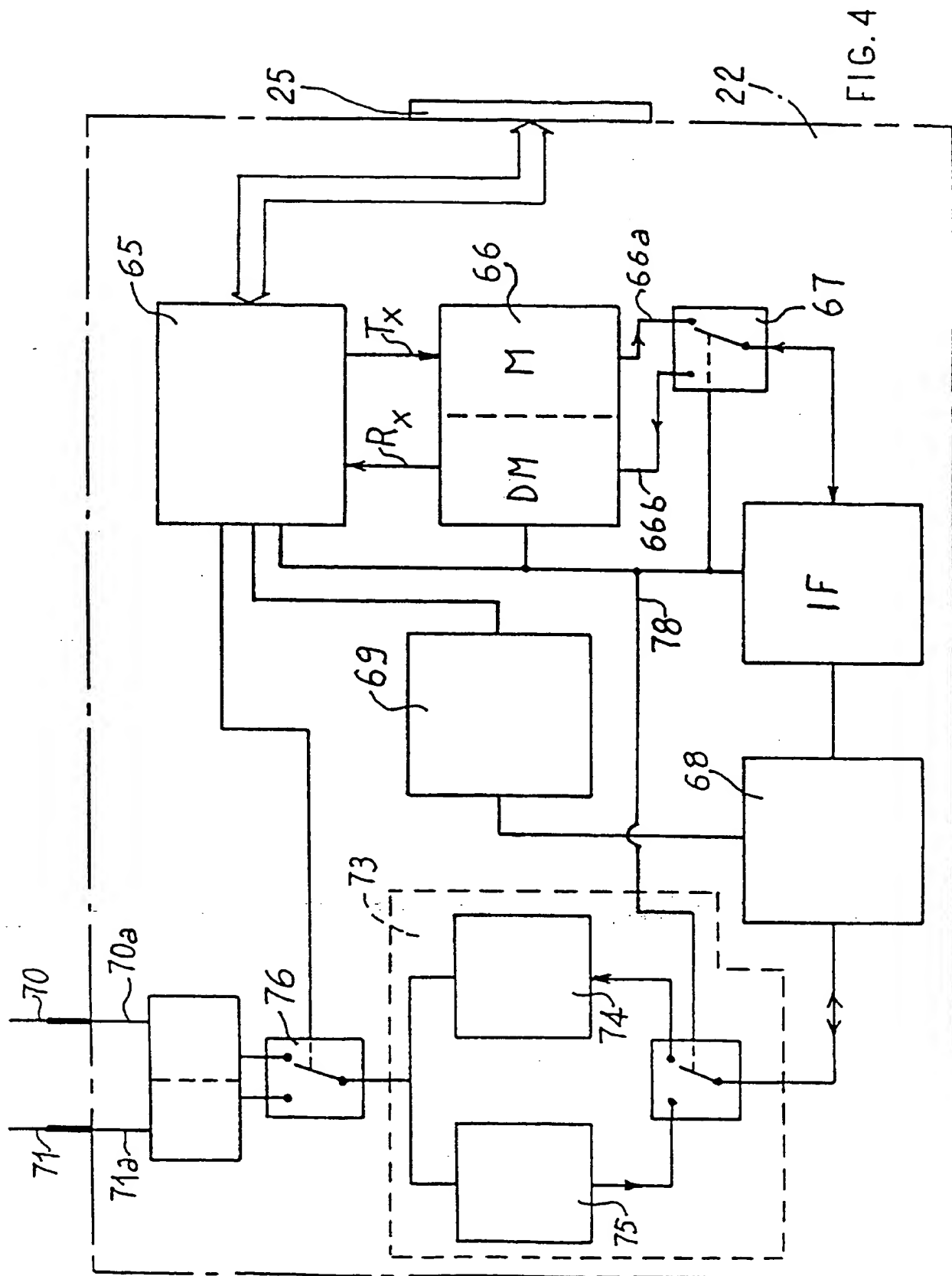
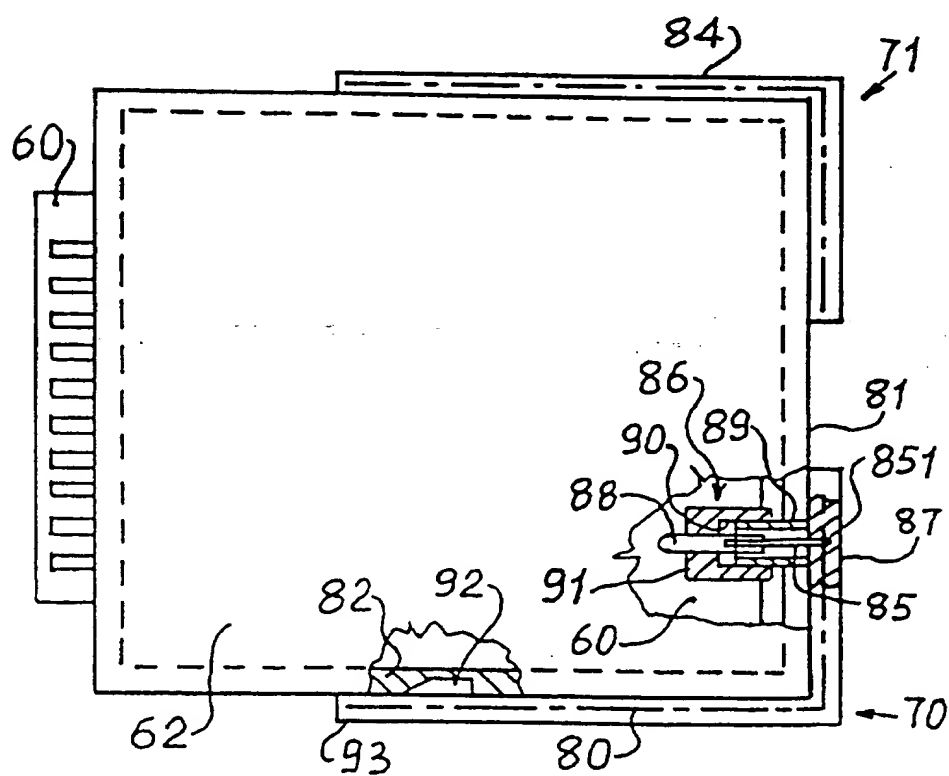
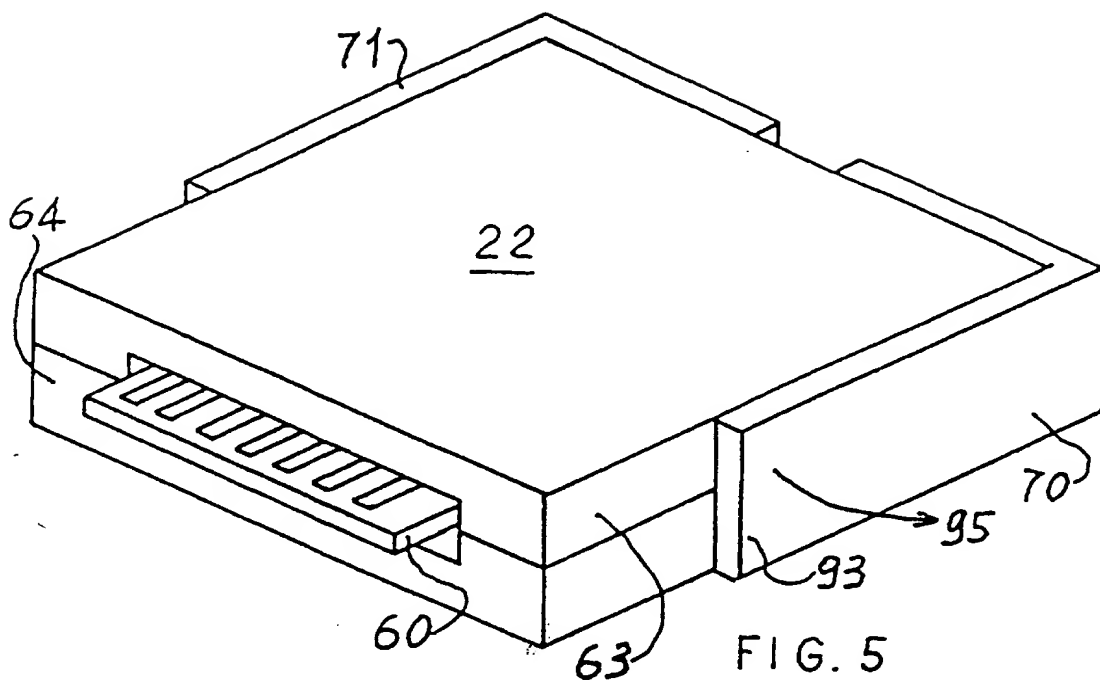


FIG.3



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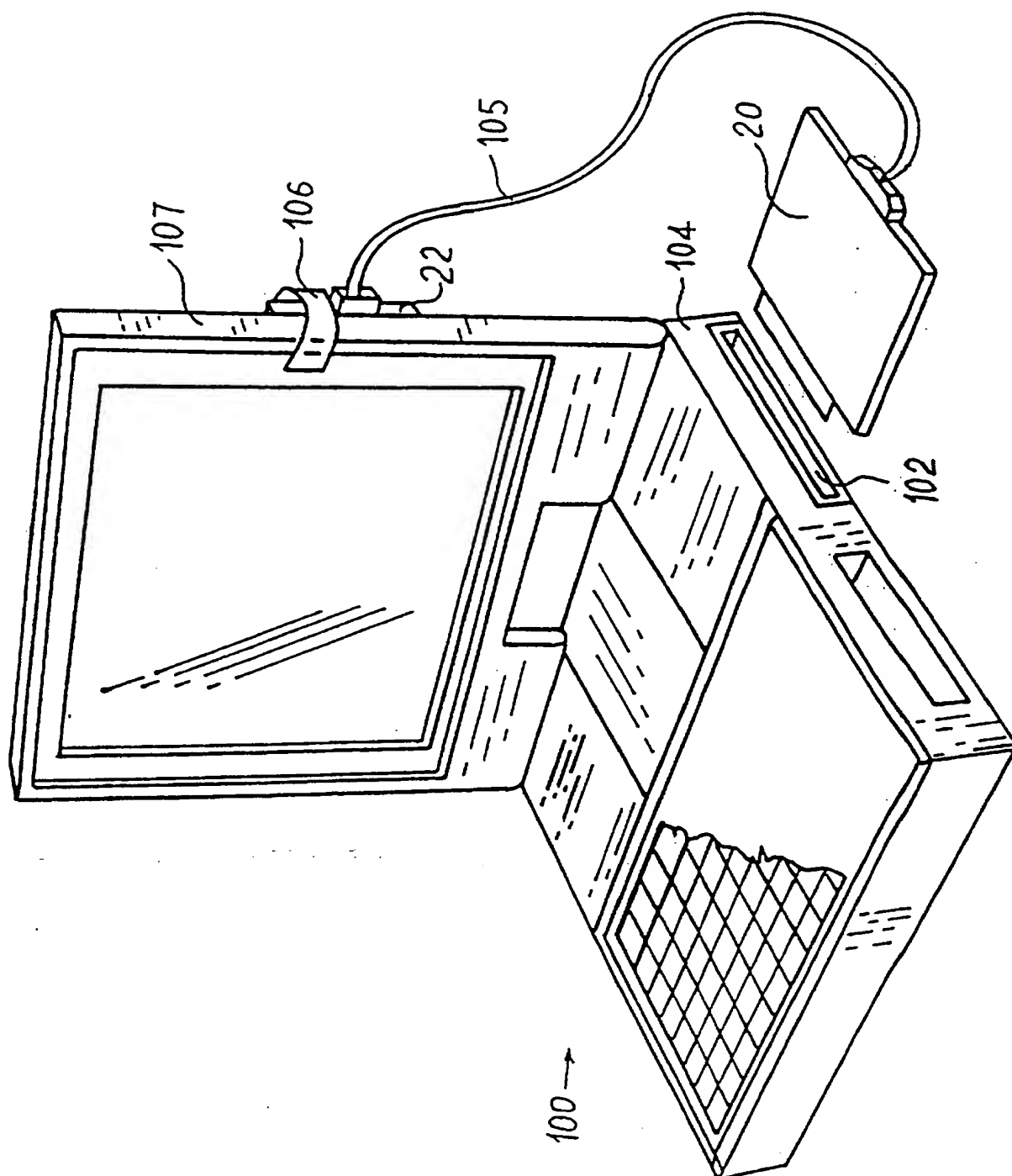
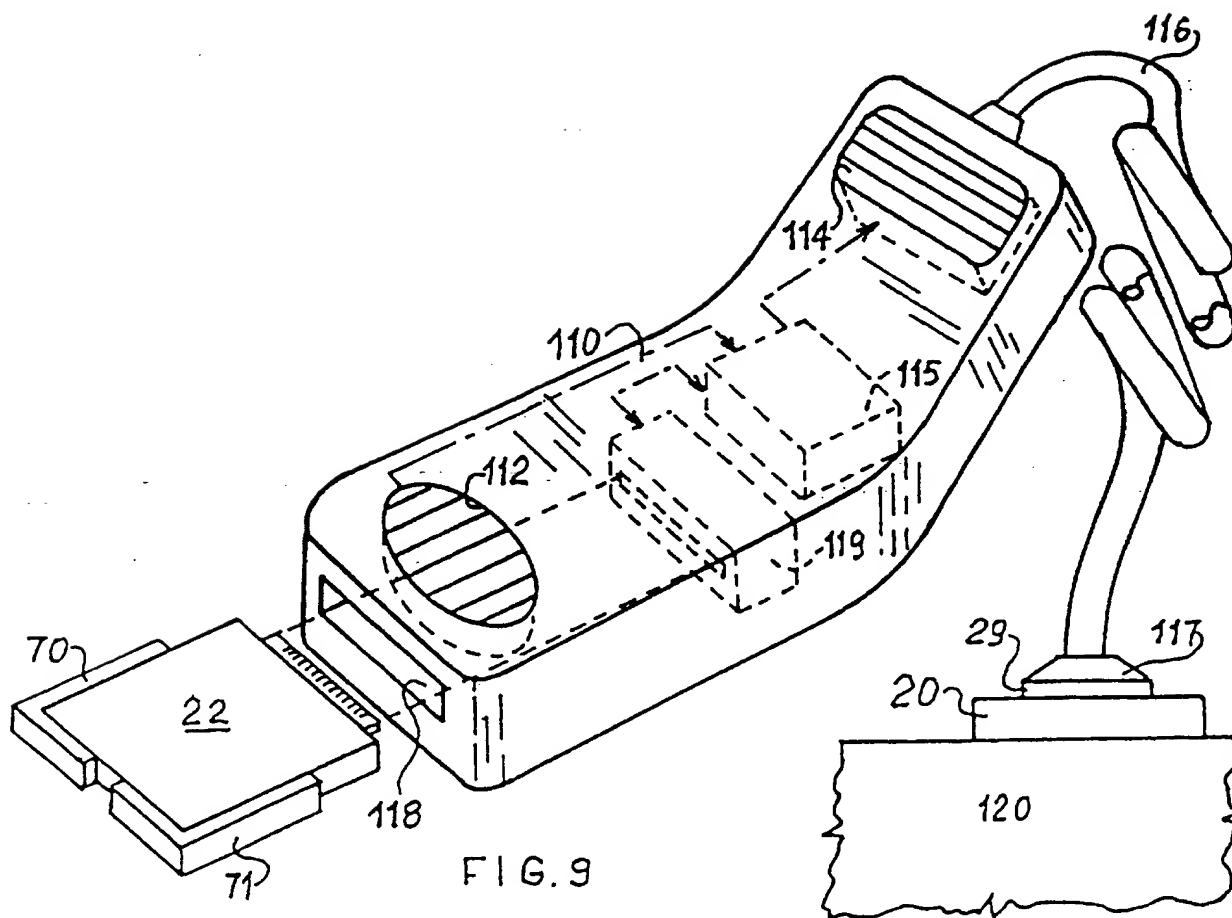
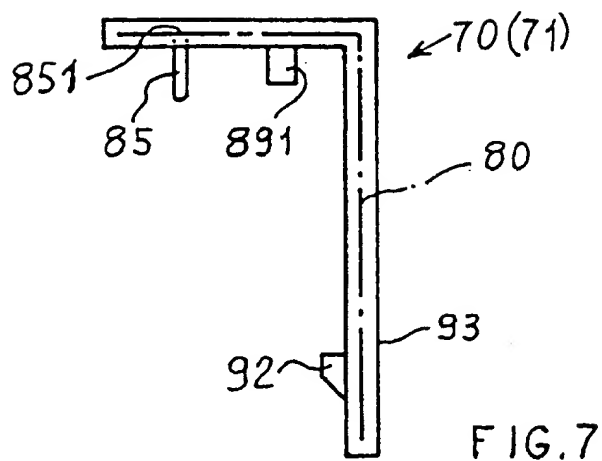


FIG. 8

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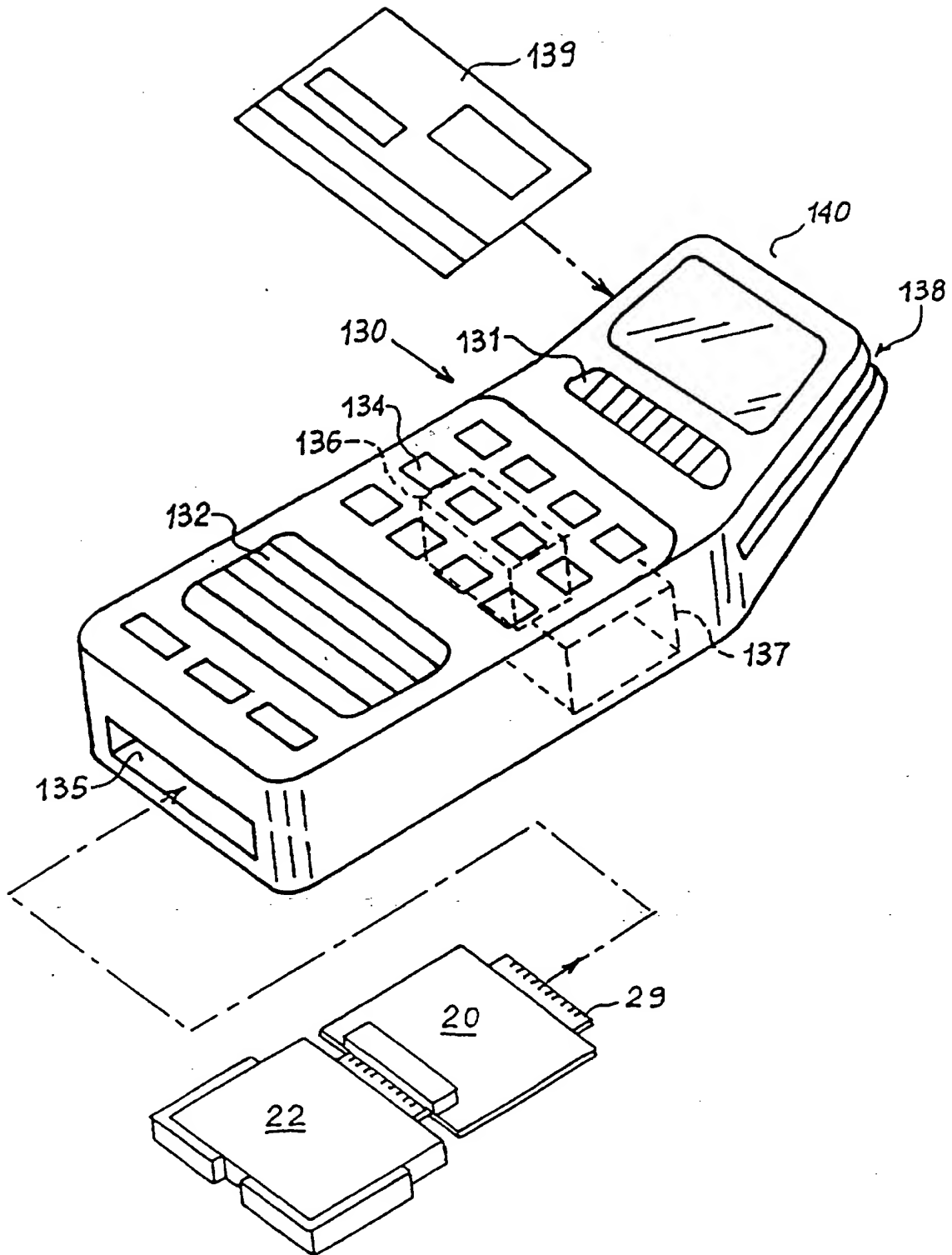


FIG. 10

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/IT 95/00116

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04B1/38 H04L12/28

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H04B H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO,A,93 07684 (SIXTEL) 15 April 1993	1-7,
A	see page 1, line 1 - page 4, line 18	12-14,
	see page 5, line 9 - page 8, line 6	17-19
X	ELECTRONICS, vol. 67, no. 5, 14 March 1994 CLEVELAND, OH, US, page 9 XP 000441000 FLETCHER 'Five-Chip Sceptre chip set delivers complete GSM in PCMCIA package'	8-11, 15, 16, 20-23
A	see the whole document	1-4, 12, 13, 15
	---	5-11, 14, 16-23
	--- -/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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* '&' document member of the same patent family

Date of the actual completion of the international search

31 October 1995

Date of mailing of the international search report

10.11.95

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INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/IT 95/00116

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	GB,A,2 277 841 (PLESSEY) 9 November 1994	1-4,12, 13
A	see page 1, line 16 - page 3, line 11; figures 1-3 ---	5-11, 14-23
X	EP,A,0 474 491 (NCR CORP) 11 March 1992	1,2,12, 14
A	see page 3, line 54 - page 4, line 31 -----	4-9, 15-17, 19,21-23